Air Methods and Characterization – Keeping Up with Environmental Priorities

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Board of Scientific Counselors

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Addressing environmental challenges…

Research

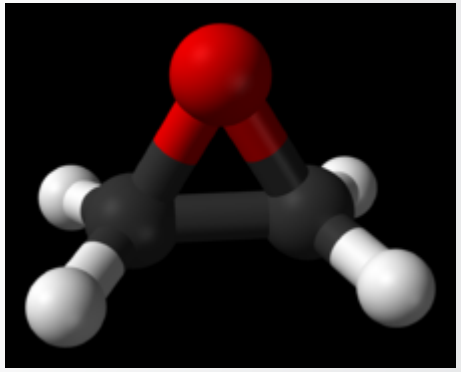
- Landscape of science is constantly evolving
- Pollutants measured at previously unseen levels of detection
- Novel, innovative technology unveiled at a rapid pace
- Emerging environmental issues and contaminants of concern

Solutions

- Development and application of innovative approaches
- Improvement in problem solving capacity
- Formation of successful alliances with stakeholders

Ethlyene Oxide (EtO)

- Integrated Risk Information System (IRIS) assessment:
  - EtO is carcinogenic to humans with IRIS/NATA/URE cancer risk >100-in-a-million is 20 ng/m^3 (~10ppt)
  - National Air Toxics Assessment (NATA) identified roughly 30 EtO-emitting facilities nationwide with cancer risk greater than 100-in-a-million
- Sources and uses (including but not limited to):
  - Production of solvents, antifreeze (ethylene glycol), textiles, detergents, adhesives, polyurethane foam, and pharmaceuticals
  - Low-temperature sterilization processing for food, medical equipment/supplies, and other sensitive materials
- Emissions:
  - Uncontrolled emissions from point and area sources
  - Fugitive emissions from industrial facilities
  - Half-life of ~200 days, unlikely formed in the atmosphere
- No method to date is sensitive enough to measure at these low levels

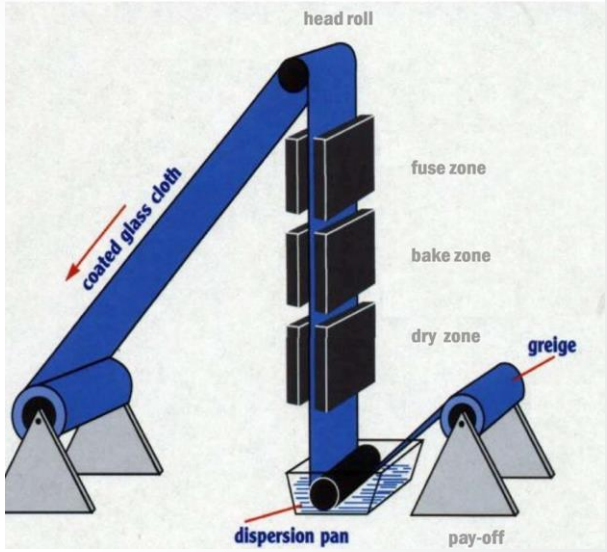


C_2H_4O

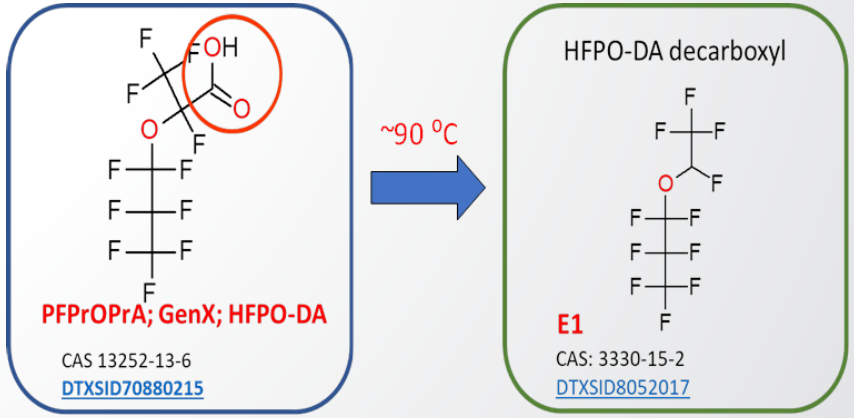
EtO is a colorless, flammable gas with an odor that is faint but sweet

PFAS Air Emissions Measurement Considerations/Challenges

- PFAS emission sources are diverse:
  - chemical manufacturers
  - used in commercial applications
  - emitted during thermal treatment of waste (e.g., AFFF, biosolids, municipal)
  - Products of Incomplete Destruction/Combustion (PIDs/PICs)
    - PICs historical term related to combustion or incineration
    - PIDs include non-combustion degradation species
- Process can alter emission composition
- Validated source and ambient air methods for PFAS do not exist, but some research methods are available
- Current emissions tests often target only a small number of PFAS compounds for analysis while significantly more may be present



Example Coating Process



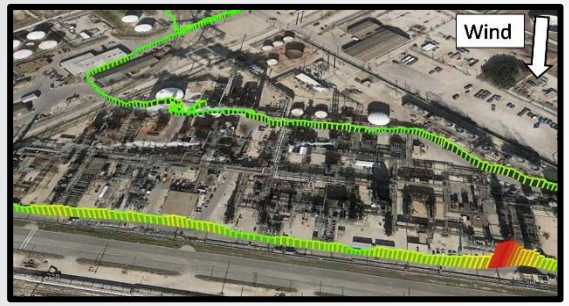
PFAS Methods & Destruction – Key Points

- Reliable and comprehensive PFAS and PFAS-related emission measurement methods are needed for multiple purposes with some in use
- Efficacy of combustion and non-combustion applications is important for all media and waste types with encouraging results and laboratory tests continuing
- Field scale testing with industry and utility partners is needed
- Collaboration and partnership both internal and external is integral to achieve the necessary guidance and tools

PFAS Products Completed

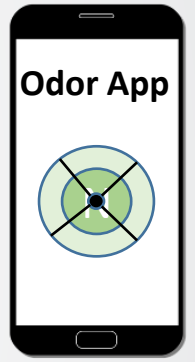
- *Other Test Method (OTM) 45* for polar PFAS compounds – https://www.epa.gov/emc/emc-other-test-methods#Other%20Test%20Methods
- *Combustion of C1& C2 PFAS: Kinetic Modeling & Experiments*. Krug, Lemieux, Linak, Lee, Ryan, Kariher, Shields, et al. AWMA IT3 Conference Publication – January 2021.
- *Review of Source and Transportation Pathways of Perfluorinated Compounds through the Air*. Owens. Journal of Environmental Health, January/February 2021; 83 (6): 20-27. https://www.neha.org/node/61725
- *Low Temperature Thermal Treatment of Gas-Phase Fluorotelomer Alcohols by Calcium Oxide*. Riedel, Wallace, Shields, Ryan, Lee, Linak. Chemosphere. https://www.sciencedirect.com/science/article/pii/S0045653521003283

Next Generation Emissions Measurement (NGEM)



Metrology

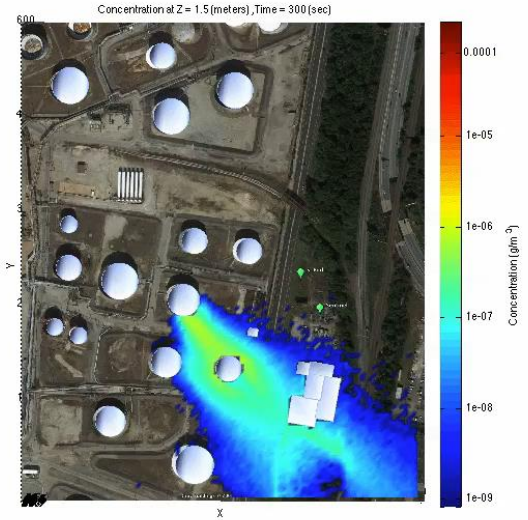
- New approaches for difficult sources
- Hybrid measurement/model systems
- Crowdsourcing odor and other observations



Metadata

Facility Sensors

Personal and Community Sensors



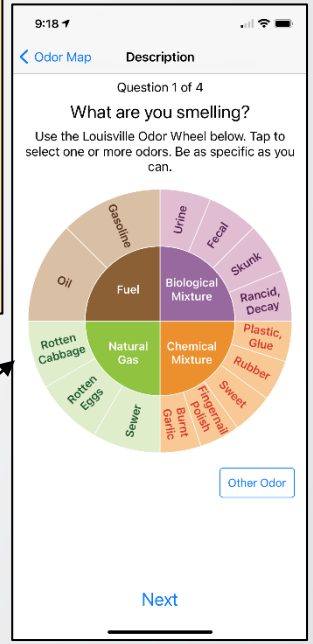
Informetrics

Near Source Impacts/ Energy/ Industry Sensors

Geospatial

Technology Application Programs

- Issue
  - Source emissions can be complex to characterize
  - Many communities (including environmental justice communities) live, work, play, and attend school in and around the vicinity of pollution sources
  - Poor air quality and odors resulting from different emissions can be a nuisance and may cause health concerns and stress for impacted communities
- Approach
  - EPA is developing a mobile app (for iOS and Android) that can be used by community members to report odors and view odor reports in their area
  - Data from the app will be paired with data from next generation emissions measurement (NGEM) systems to capture a chemical 'fingerprint' of emissions
- Anticipated Outcomes
  - Demonstrate utility of combining a variety of data types (citizen science and NGEM) to help better understand emissions
  - Engage communities and increase transparency
  - Help EPA Regions, state/local agencies, and industries evaluate air pollution and odor control strategies



Odor Wheel

Captures detailed information about odors

Summary

- With the ability to measure our environment at previously unseen levels of detection, the landscape of science is constantly evolving
- Emerging environmental issues and contaminants of concern are being investigated to answer the immediate questions of uncertainty with regards to public health and exposure
- Novel, innovative technology is being unveiled at a rapid pace and evaluated for relevance in measuring and monitoring priority areas
- The development or application of an innovative approach; improvement in problem solving capacity; and formation of successful alliances with stakeholders are strategic means for advancing our knowledge to the rapidly changing surroundings

Questions

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